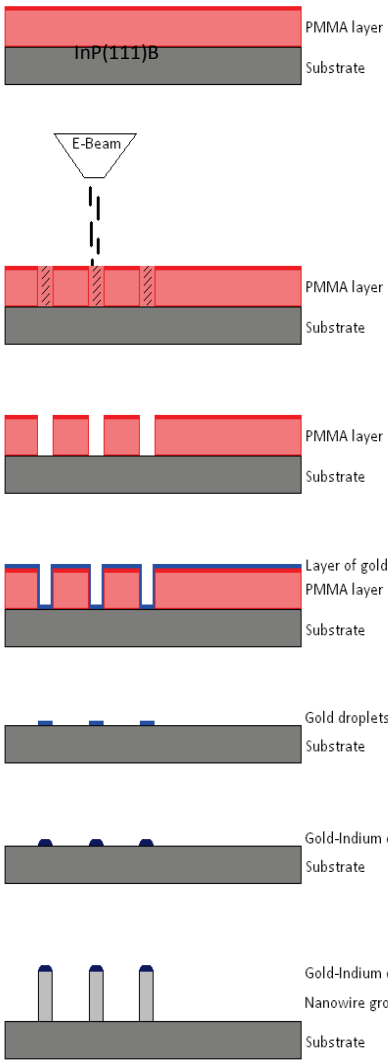
Supplementary Material Section 1:

E-beam lithography, gold deposition and lift-off were used to prepare the 25x25 gold droplet arrays.

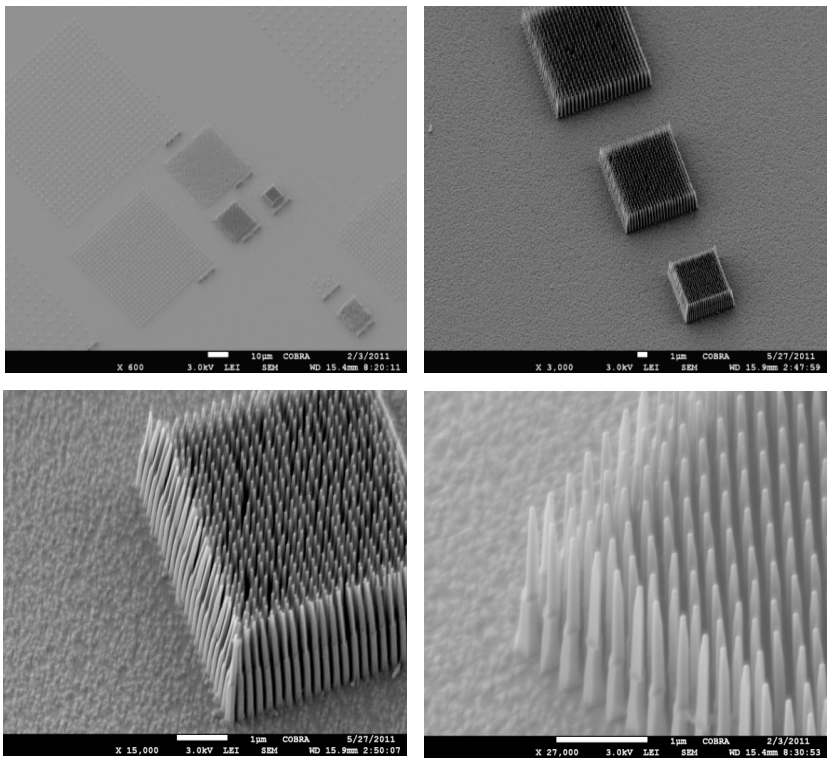
"Standard" InP-InAs stems were grown in the MOVPE reactor at 420°C.



Standard patterning of the substrates by e-beam lithography

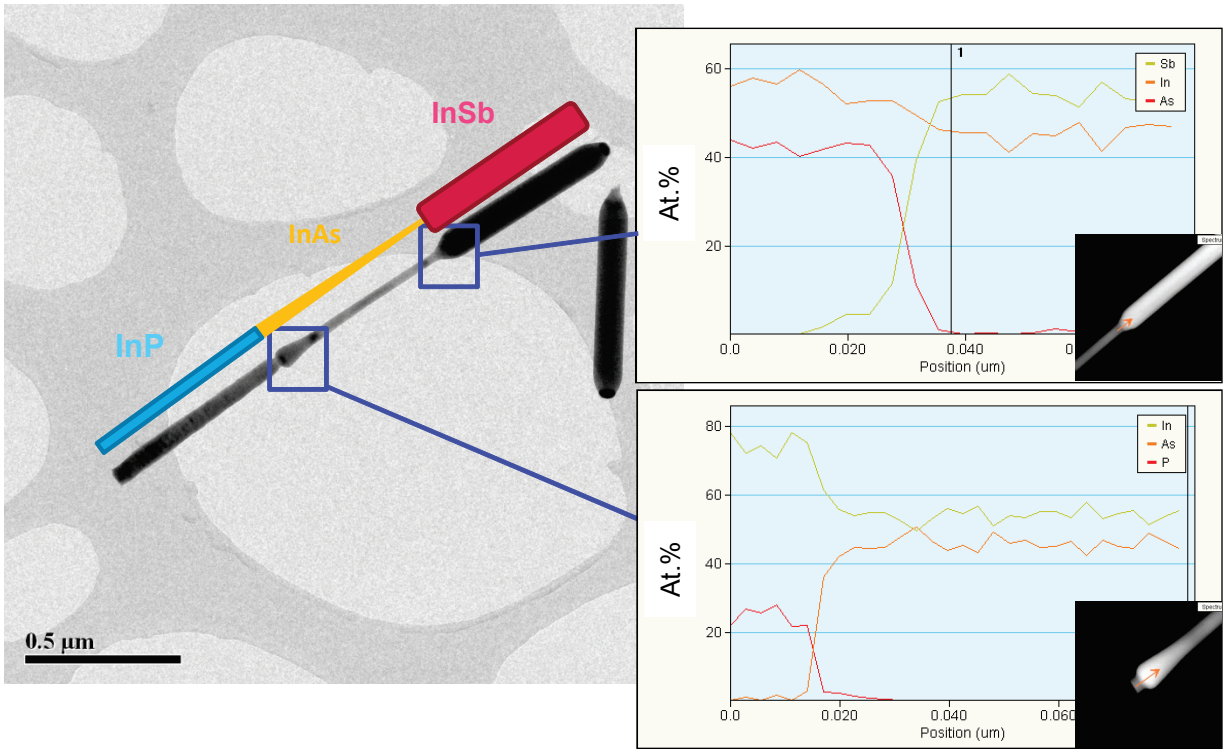
+

Growth of InP – InAs stems

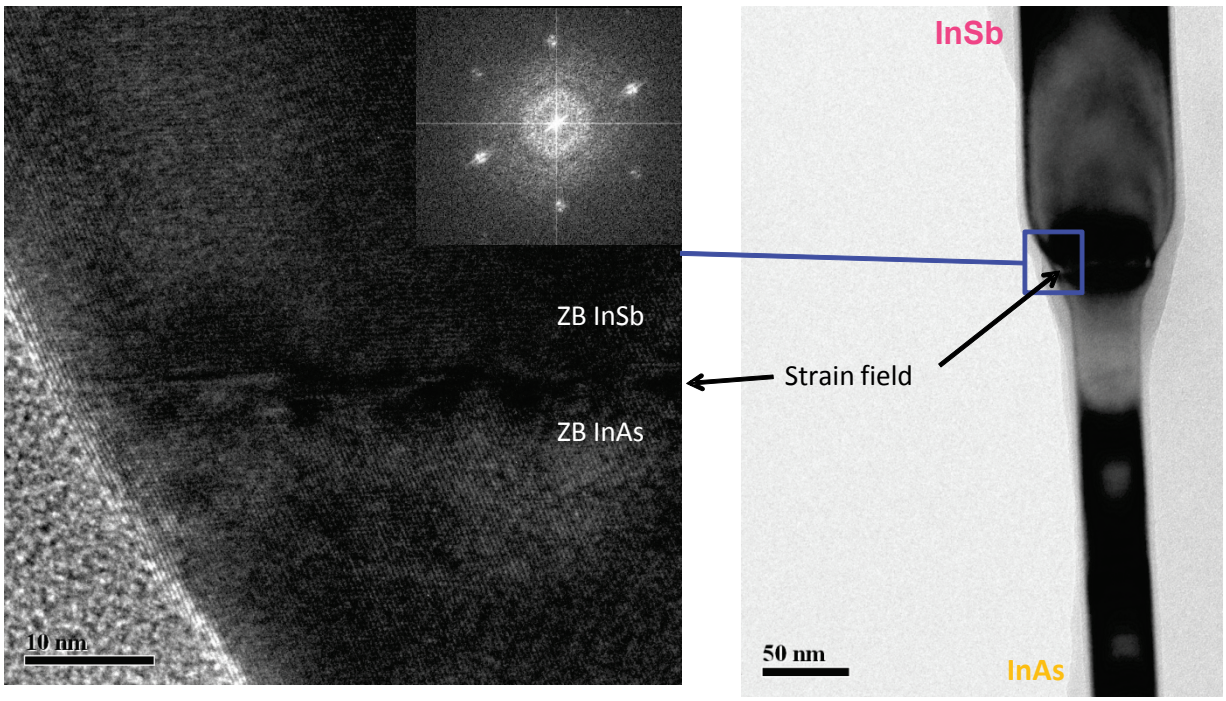


Supplementary Material Section 2:

EDX measurements performed in the TEM: the interfaces.



HR-TEM measurements: the crystalline structure from pure ZB InAs to pure ZB InSb.

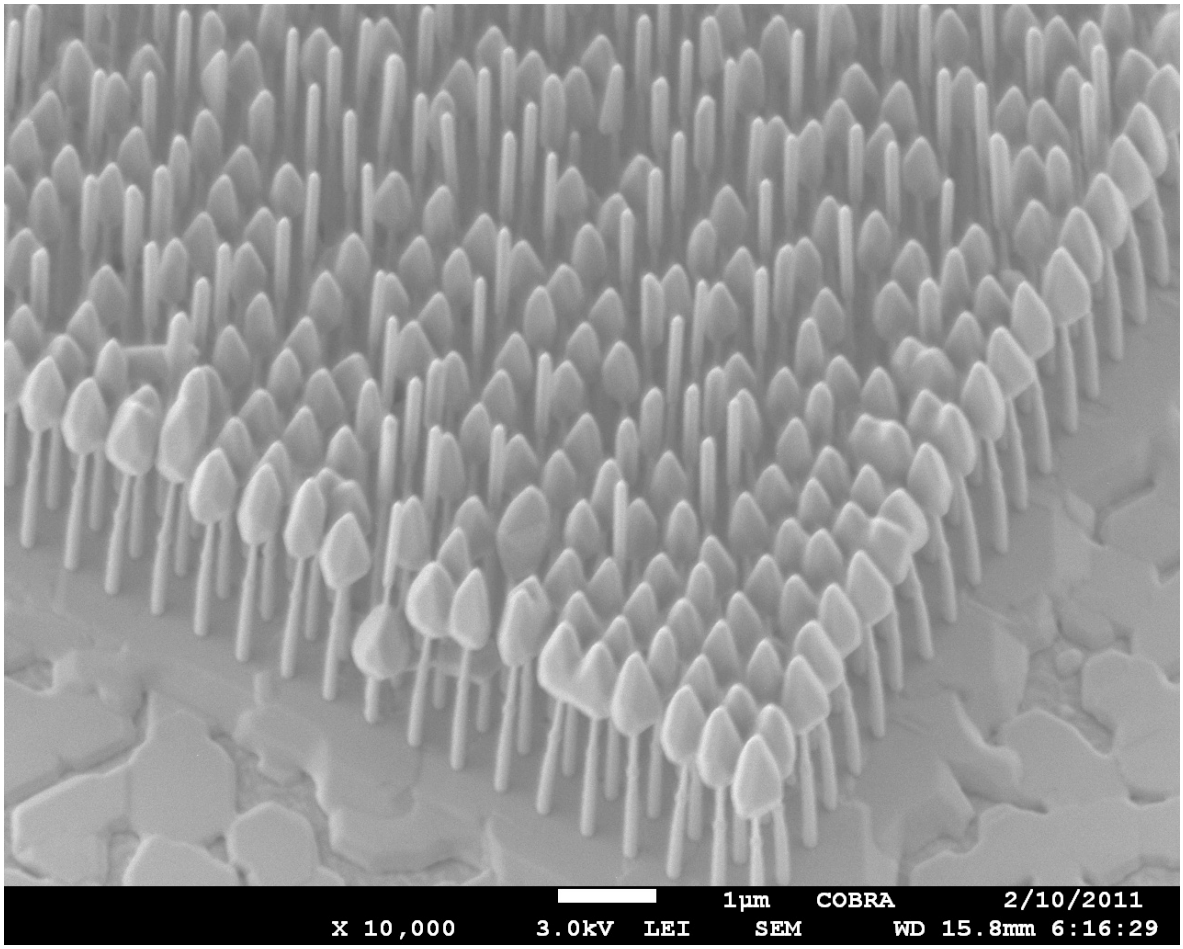


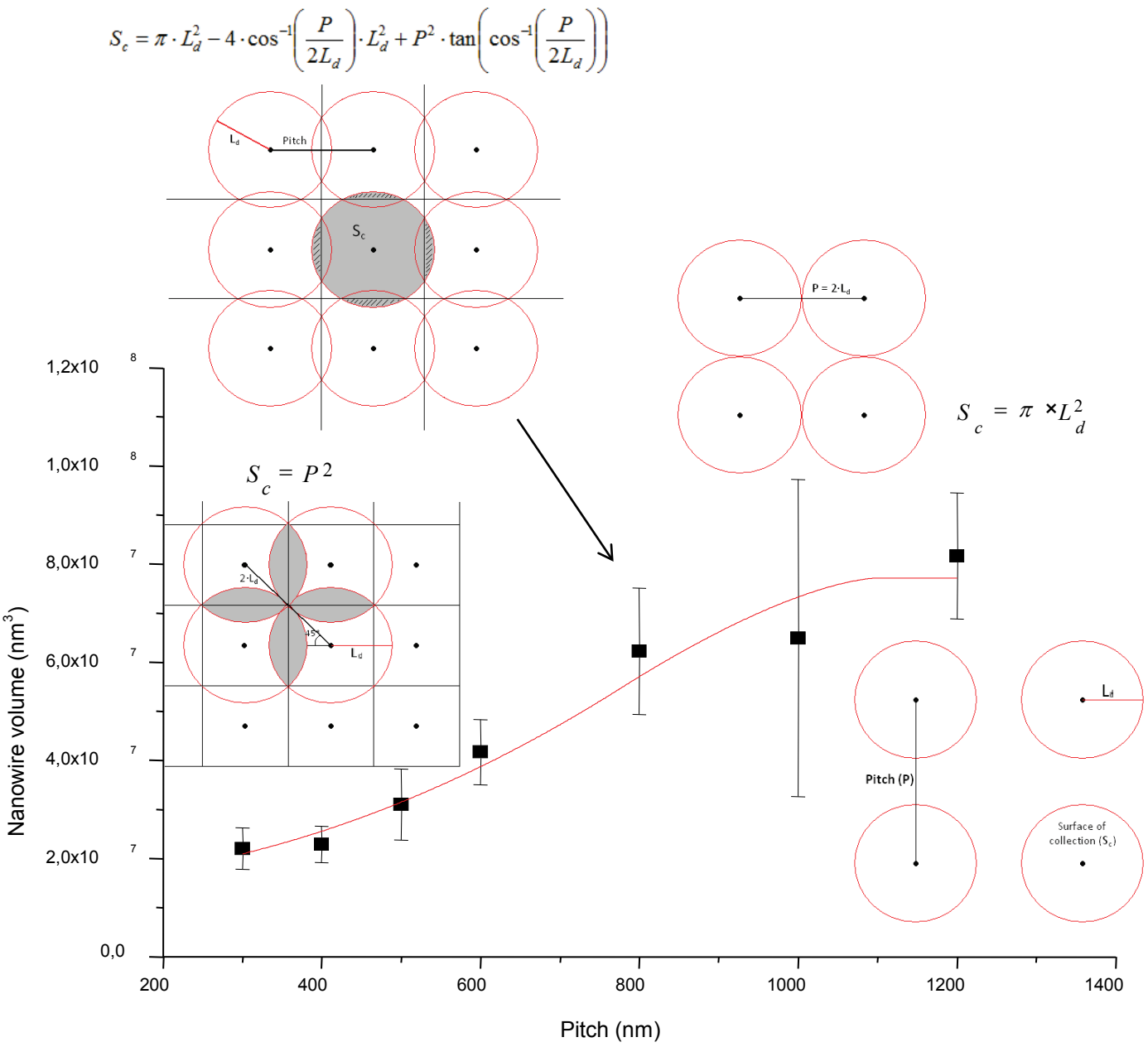
Supplementary Material Section 3:

Diffusion length of the precursors: Nanocubes at the side of the arrays / Nanowires in the middle

=> The V/III ratio is lower in the middle of the arrays

=> TMSb has a shorter diffusion length





Estimation of the diffusion length as a function of the nanowire volume (area of collection):

see Gotschke et al. Applied Physics Letters 2001, 98, 103102

Estimation of the Sb diffusion length

V/III ratio	Diffusion length L_d (nm)
44	542 ± 88
55	597 ± 296
66	491 ± 47

Supplementary Material Section 4:

To confirm the hypothesis proposed about the droplet composition evolution, EDX measurements in the TEM were performed on droplets after growths. Three samples were prepared having the same droplet size (75 nm) but three different pitches (300 nm, 500 nm and 800 nm) corresponding to the three different areas of figure 3b. These samples were grown at the same time with a V/III ratio of 33.1 but were cooled down without any TMI or TMSb flow. This procedure has already been used to measure the droplet composition of GaSb nanowires grown by MOVPE[1], and even if the measured compositions after growth can differ from the droplet compositions during growth, we believe that the trend should remains the same. A dark field TEM image of a droplet is presented in figure S4a and the droplet composition evolution as a function of the pitch is given in figure S4b. It is important to note that the indium L-line of the EDX measurement can be partially absorbed by gold present in the droplet leading to large error bars, but a trend can still be observed in figure S4b: decreasing the nanowire interdistance leads to an increase of the indium composition in the droplet, which is coherent with the hypothesis proposed before. Interestingly if compared to figure 3b, the minimum in diameter for the 75 nm gold droplets seems to correspond to the $AuIn_2$ composition.

[1] Weng X.; Burke R. A.; Dickey E. C.; Redwing J. M. *J. Crys. Growth* **2010**, *312*, 514-519

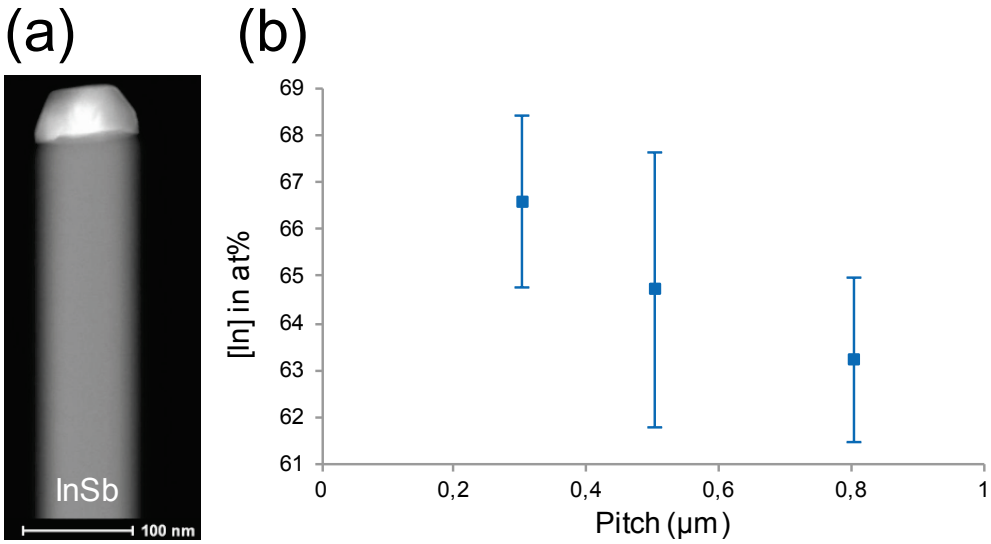


Figure S4: Energy dispersive X-ray (EDX) measurements performed on the 75 nm droplet in a TEM after cooling down under nothing. (a) Dark field image of the top part of an InSb nanowire. (b) Quantitative EDX measurements of the indium concentration in the droplet in atomic percentage in function of the nanowire interdistance. Each point corresponds to the mean indium concentration measured for 10 nanowires and the error bars corresponds to the standard deviation.

Supplementary Material Section 5:

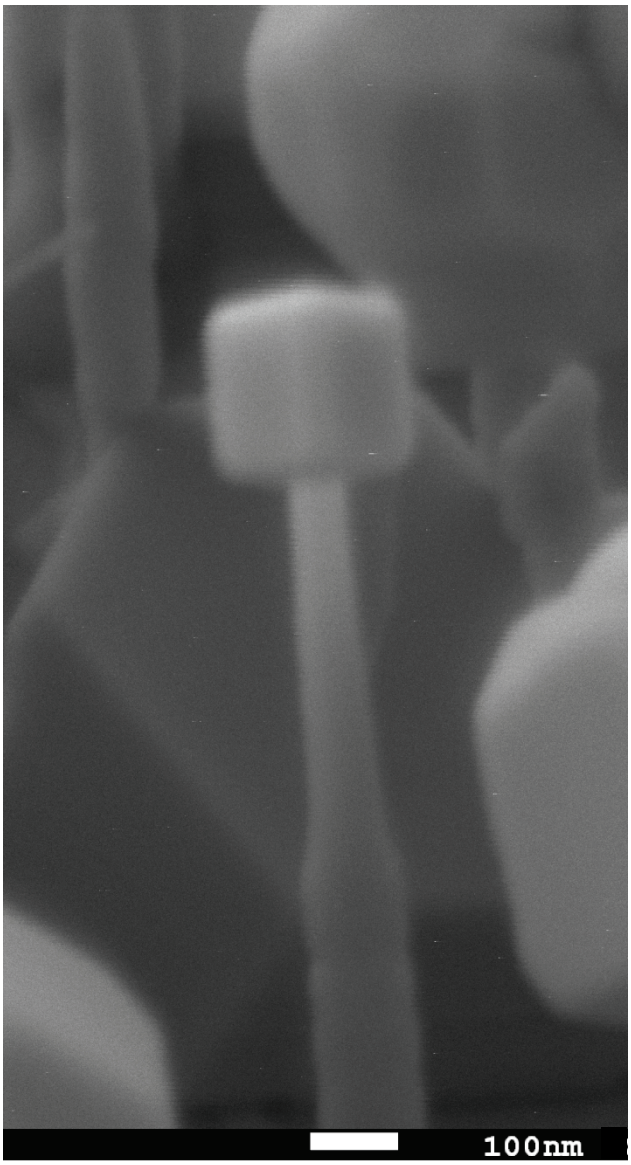


Figure S5: 30° tilted SEM image of a "Nanocube" with a smaller diameter (lower InSb growth time). The "Nanocube" diameter is directly proportional to the InSb growth time: here the side of the cube is around 120nm.

Supplementary Material Section 6:

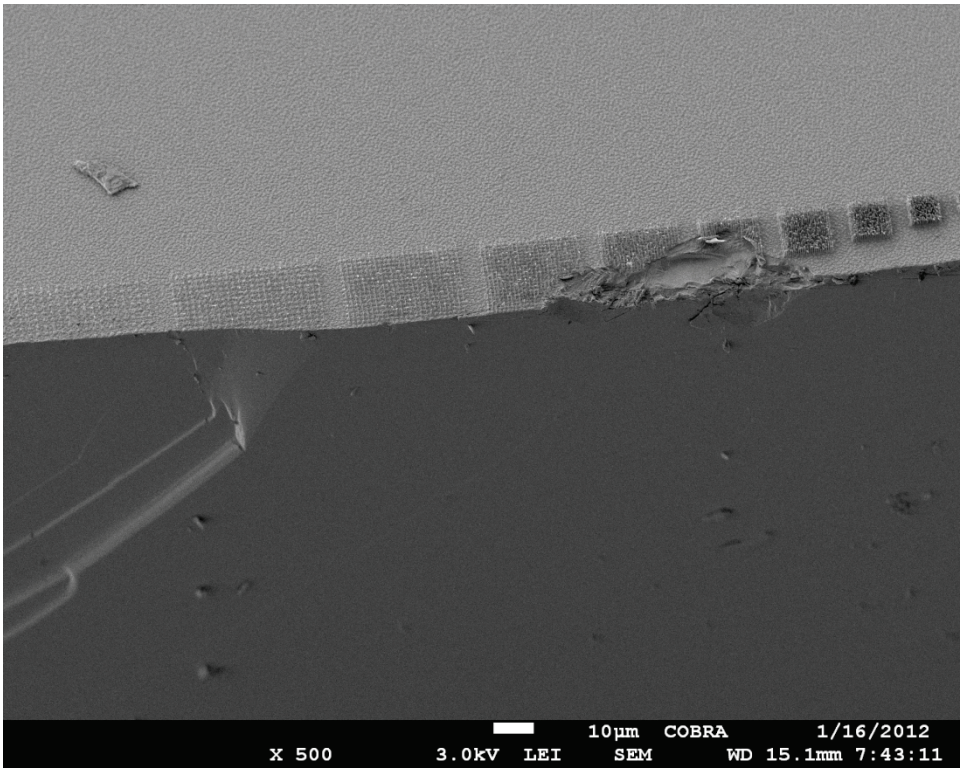


Figure S6(a): 30° tilted SEM image of a nanowire array field. A cleaving through the patterns allows us to estimate the parasitic bulk growth

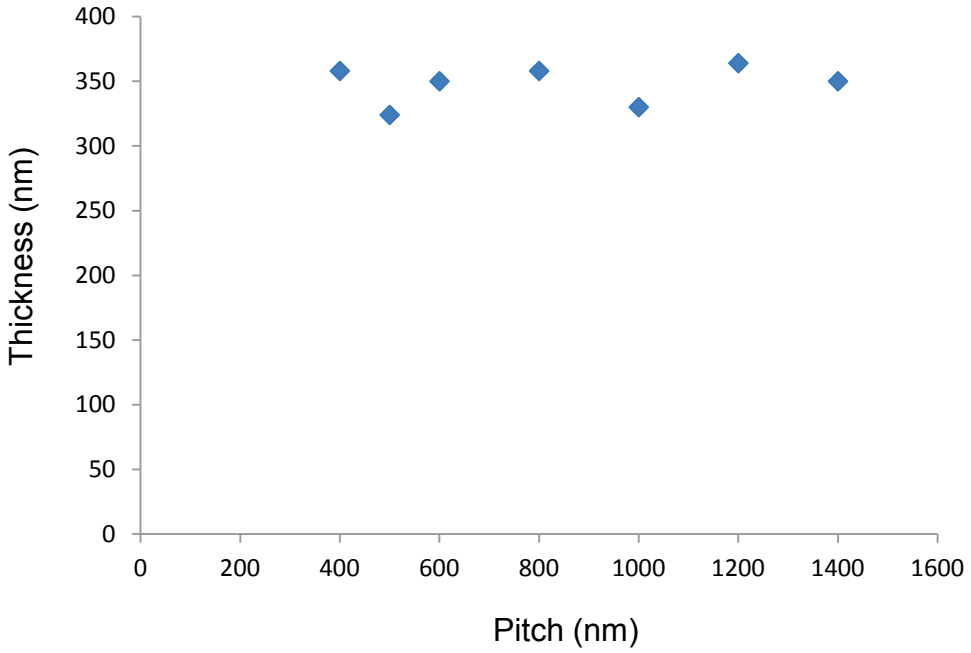


Figure S6(b): Thickness of the parasitic 2D growth in function of the pitch. No significant influence of the pitch (i.e. of the 'local' V/III ratio) on the parasitic layer growth can be found. We estimate this influence as a constant offset in out model.

Supplementary Material Section 7:

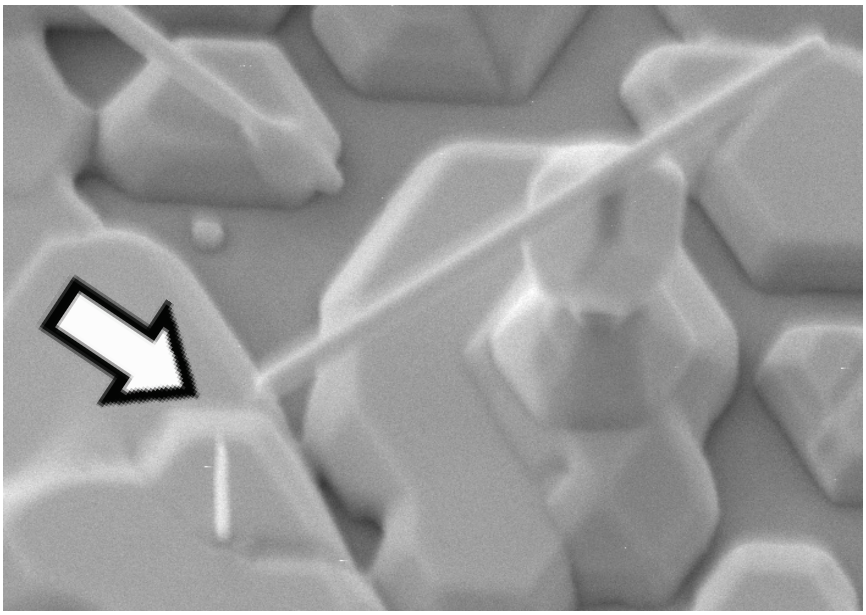


Figure S7: 30° tilted SEM image of InSb nanowires.
The arrow shows a InAs stem completely evaporated during the InSb growth.